3.28 RESULTS FOR RANGE TRACK

This assessment is based upon comparisons between the range gate servo transient response plot shown in Reference 7 and the transient response plot generated with *RADGUNS* v.1.9 for the same system. The model should produce a transient response plot similar to the one shown in the reference in terms of percent overshoot, peak time, rise time, and settling time. Results for this assessment are shown in Table 3.28-1.

TABLE 3.28-1. Range Track Assessment Results.

Data Source	Major Conditions	Statistical MOEs	Results
Reference 7 RTL transient response plots	Intel model of RTL subsystems	% Difference:	
		% Overshoot	11
		Rise Time (90%)	0
		Settling Time (±10%)	7
		Peak Time	0

3.28.1 Assessment – Case 1

Test Data Description. The range track loop (RTL) is shown in block diagram form in Reference 7. The responses of many of the individual blocks are shown, though it is not clear whether any of these plots present measured data, and many of the responses are known to be intelligence estimates. An intelligence model of the RTL was developed from the block diagrams and step response plots were generated for minimum, nominal, and maximum loop gains (this gain is determined by the setting of the potentiometer shown in the block diagram). A single equation transfer function is not presented for the RTL in the reference.

Validation Methodology. Subroutine RSERVO in *RADGUNS* positions the range gate based on an error signal generated from the difference between the perceived target range and the current position of the range gate center. A single transfer function is used to model the RTL. In versions prior to v.1.9, the range gate position was updated at the radar scan rate, however, validation on v.1.8 revealed a discrepancy between the model generated transient response and the response shown in Reference 7. As a result, v.1.9 uses the same transfer function as previous versions, however, the range gate position is updated at the pulse rate.

Changes to the source code were made to allow a variation in loop gain. The model was executed with the following input conditions:

Model Mode:	SINGL/RADAR
Target Type:	PROFIL, 10 m^2
Flight Path:	STOPS2, 11.24 m jump between stops
RTL gain settings:	minimum, nominal, maximum
Radar Type:	RAD1
MTI Mode:	OFF
Clutter/Multipath:	None
Output:	Range gate position

The 11.24 m jump between flight path stops translates to a 75 ns step in range.

Results

Figure 3.28-1 shows the response of the RTL to a 75 ns step. The heavy dotted line is the response shown in Reference 7 with the minimum loop gain while the heavy solid line represents the response with maximum gain. The normal solid and dotted lines represent the modeled response at the maximum and minimum gains respectively. Table 3.28-2 shows the percentage overshoot, rise time, settling time, and peak time associated with each curve.

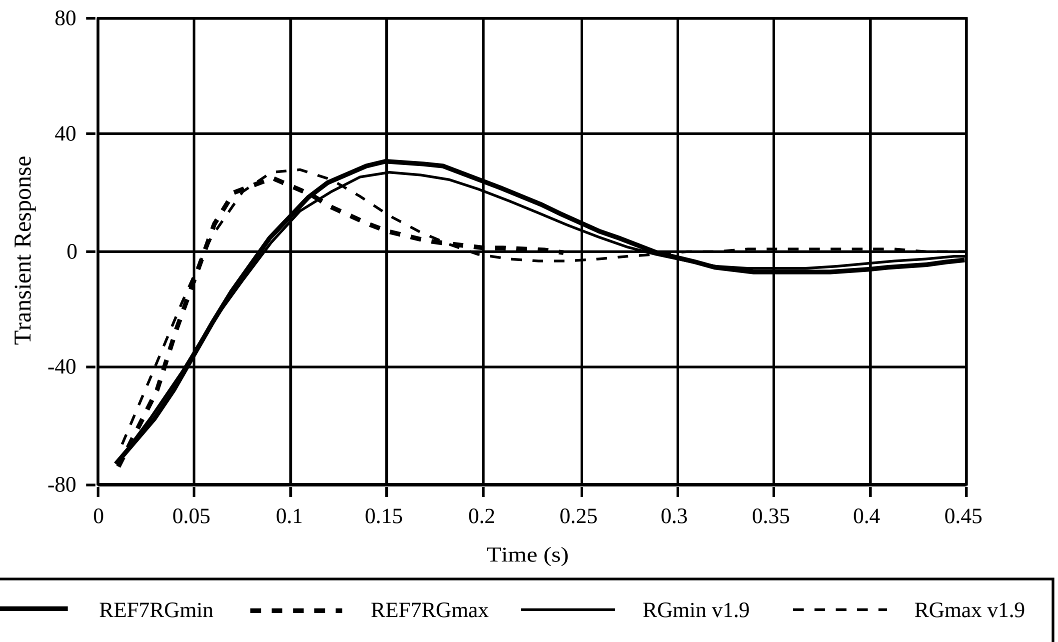

FIGURE 3.28-1. Range Servo Transient Response - 75 ns Step.

TABLE 3.28-2. Range Track Loop Transient Response Characteristics.

	Minimum Gain		Nominal Gain		Maximum Gain	
	RG 1.9	**Reference 7**	**RG 1.9**	**Reference 7**	**RG 1.9**	**Reference 7**
% Overshoot	35.86	40.13	36.34	37.58	37.28	34.09
Rise Time (s)	0.08	0.08	0.06	0.06	0.05	0.05
Settling Time (s)	0.39	0.39	0.20	0.19	0.16	0.15
Peak Time (s)	0.15	0.15	0.12	0.12	0.09	0.09

Conclusions

The percentage overshoot increases in the model responses as gain increases; whereas, in the reference, the overshoot decreases with increased gain. Even so, the small difference in overshoot should have very little effect on overall tracking performance given the excellent correlation in rise, peak, and settling times.